

# ***PLANNING FOR CALIFORNIA'S FUTURE TRANSMISSION GRID***

## ***Review of Transmission System, Strategic Benefits, Planning Issues, and Policy Recommendations***

Energy Commission Committee Workshop In Preparation of  
2004 Integrated Energy Policy Report Update

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# Overview

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- Summarize the development of California's transmission interconnections.
- Describe the benefits and value of California's transmission interconnections.
- Review status and issues for proposed new transmission projects.
- Suggest policy issues for consideration in planning California's grid of the future.

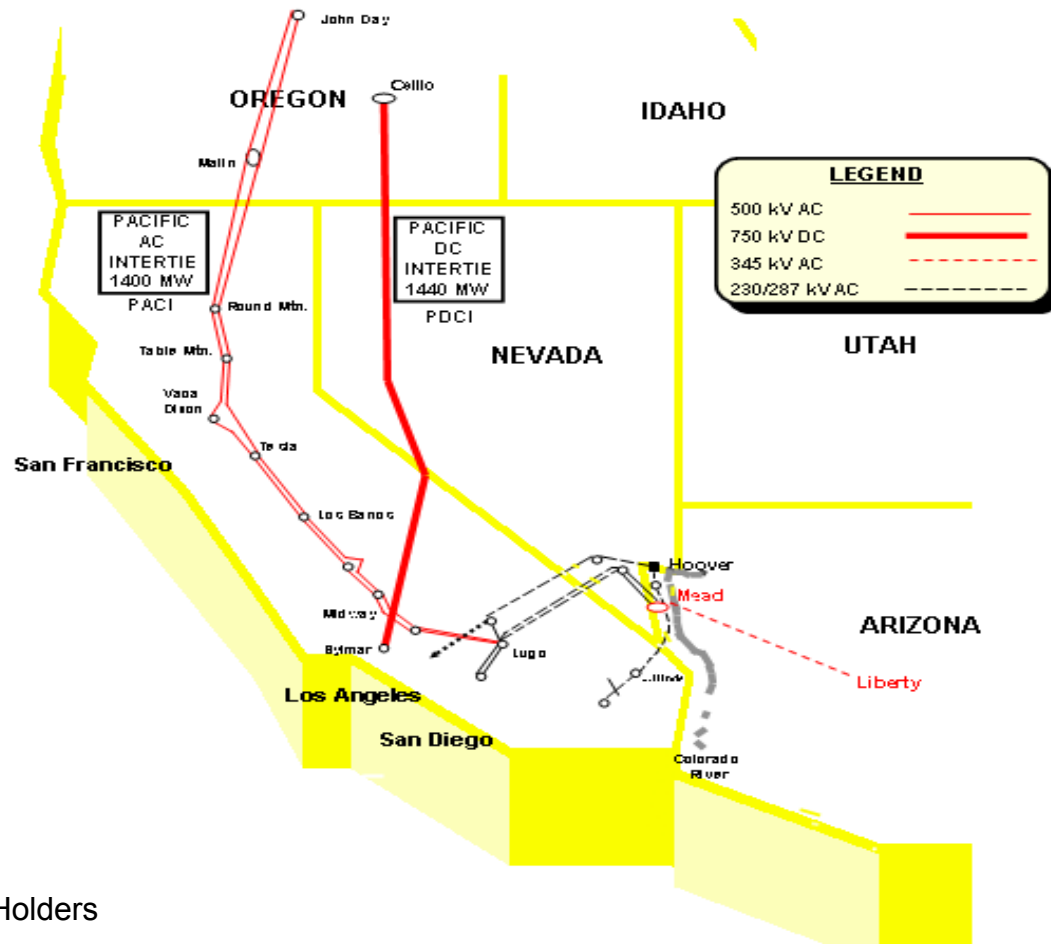
# *Interconnections to the Pacific Northwest 1969 and 1970*

## **Pacific AC Intertie \***

- PG&E
- SCE
- SDG&E
- CDWR
- SMUD
- WAPA

## **Pacific DC Intertie \***

- LADWP
- Burbank
- Glendale
- Pasadena
- PG&E
- SCE
- SDG&E



\* Initial Line Owners and Rights Holders

# *Interconnections to the Desert Southwest - 1969 through 1974*

## East-of-the-River (Northern System)

Navajo-McCullough 500 kV Line \*

- LADWP
- NPC
- WAPA

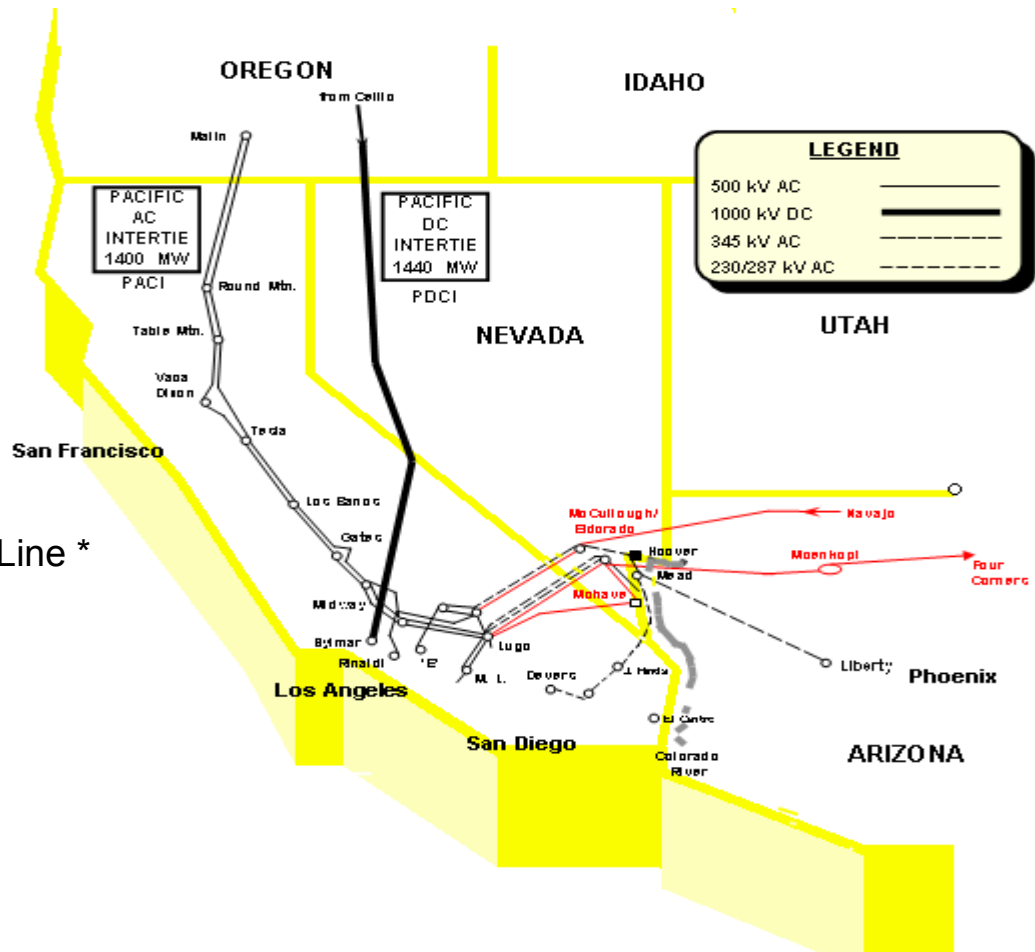
Eldorado-Moenkopi-Four Corners 500 kV Line \*

- SCE

Mead-Liberty 345 kV Line \*

- WAPA
- SRP

\* Initial Line Owners and Rights Holders



# *Interconnections to the Desert Southwest 1983 and 1984*

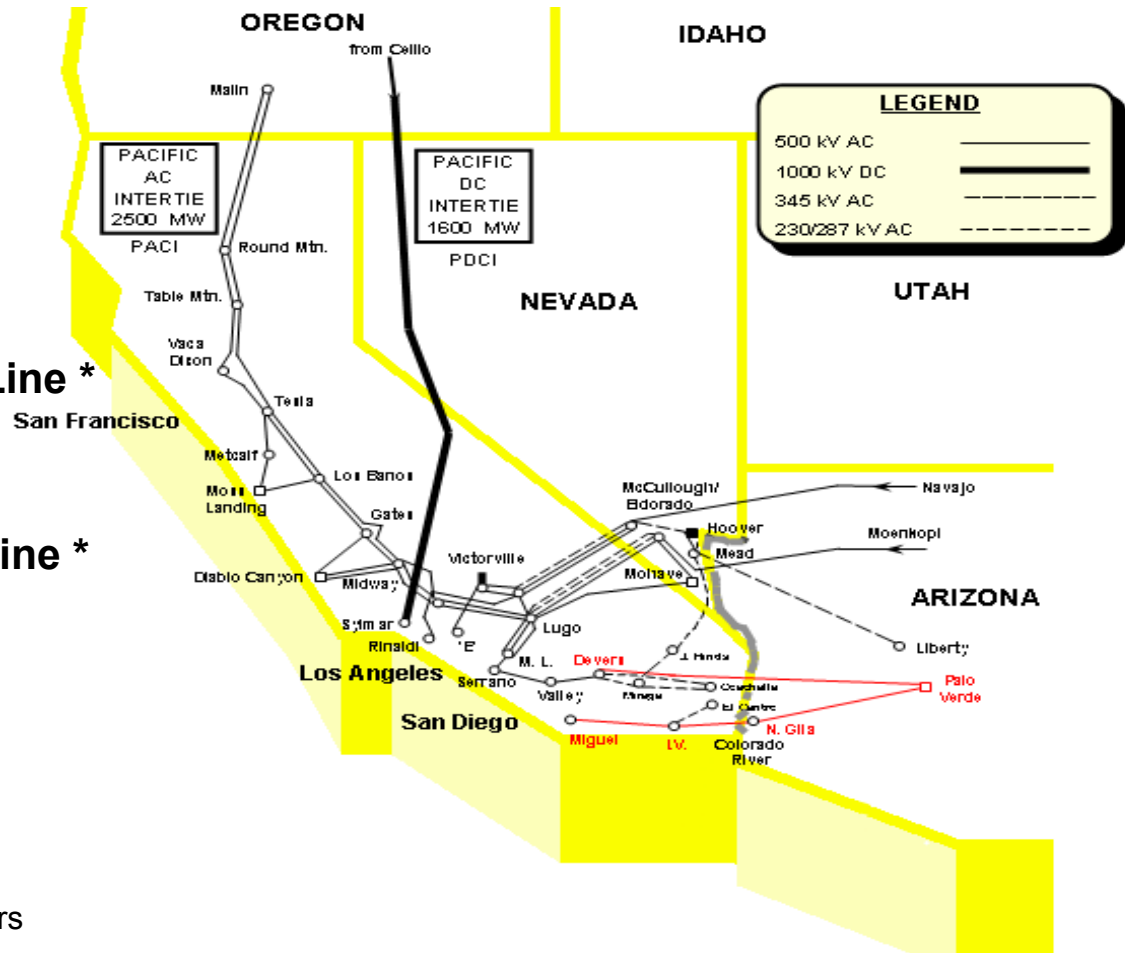
## East-of-the-River (Southern System)

### Devers-Palo Verde 500 kV Line \*

- SCE

### Palo Verde-Miguel 500 kV Line \*

- APS
- IID
- SDG&E

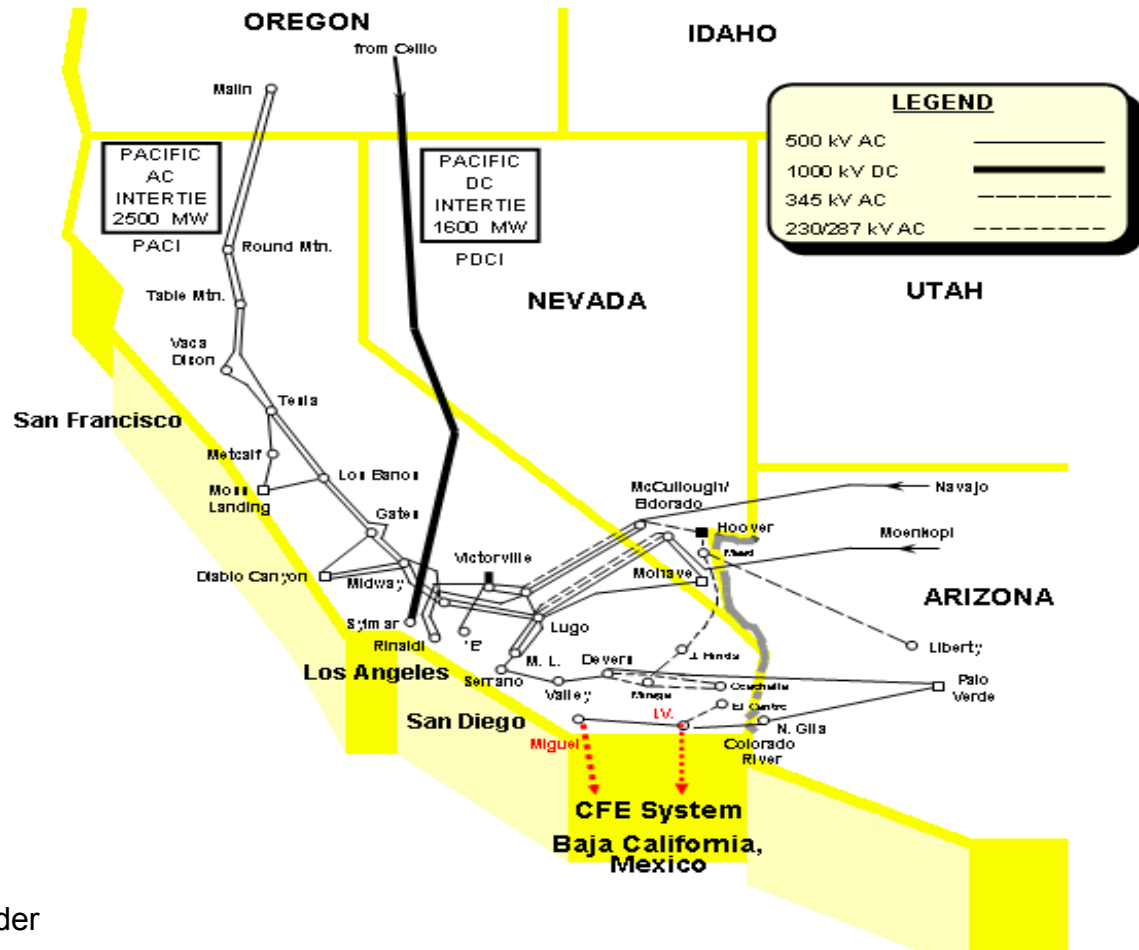


\* Initial Line Owners and Rights Holders

# *Interconnections to Mexico – Baja California - 1984*

## **Miguel-Tijuana and Imperial Valley- La Rosita 230 kV Lines \***

- SDG&E
- SCE
- CFE

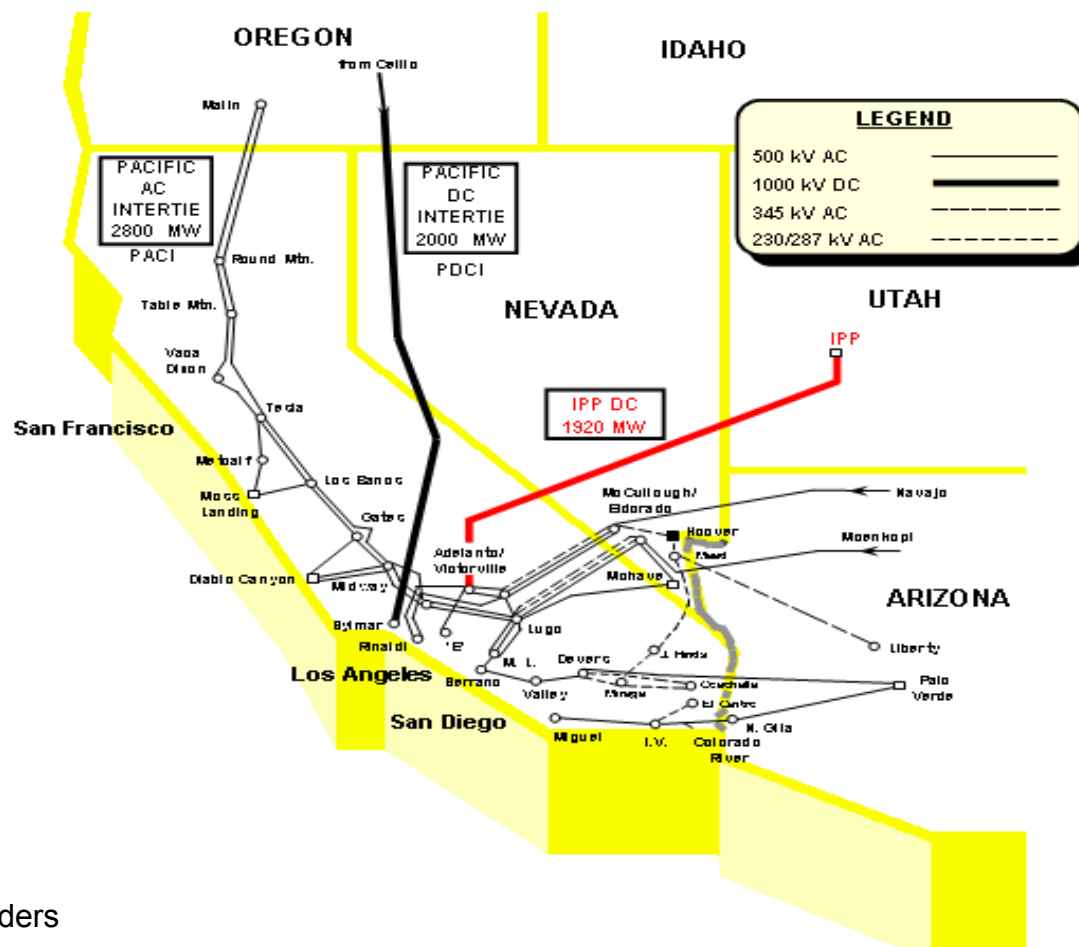


\* Initial Line Owner and Rights Holder

# Interconnections to Utah - 1987

## Intermountain Power Project \*

- LADWP
- Anaheim
- Burbank
- Glendale
- Pasadena
- Riverside



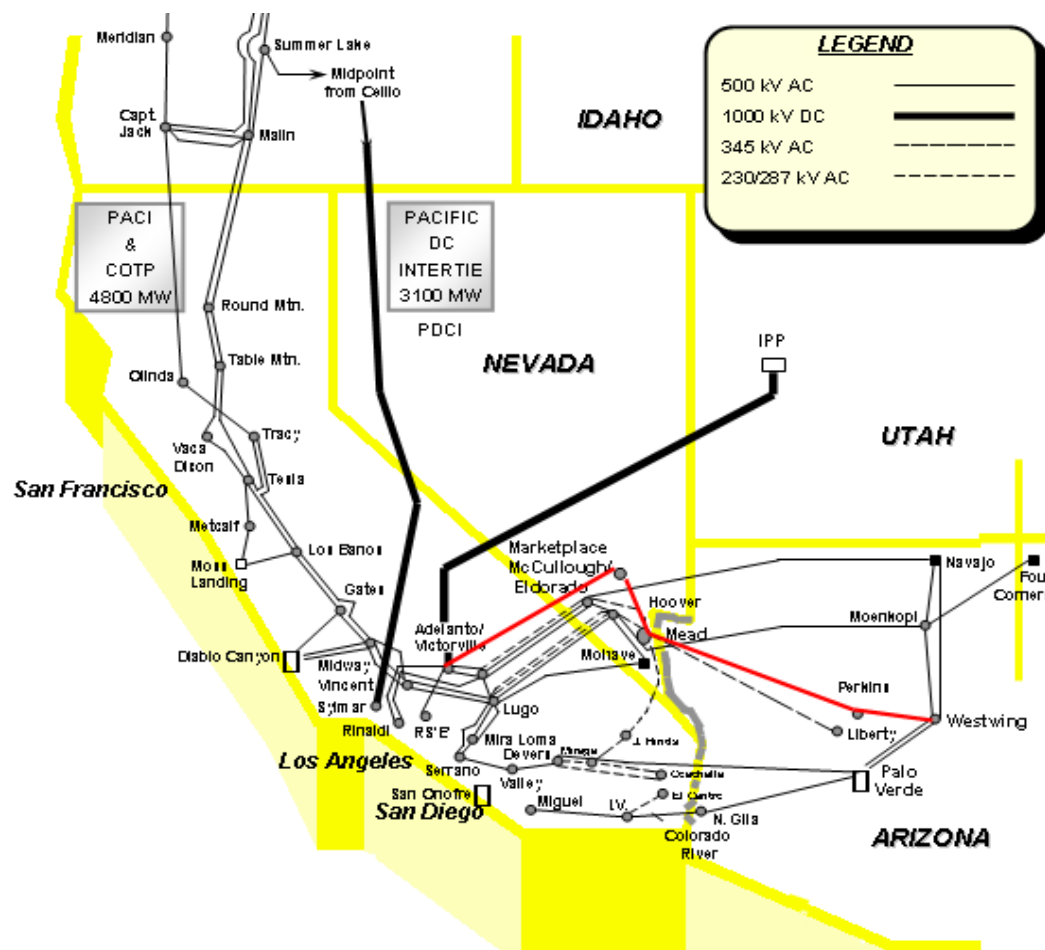
\* Initial Line Owners and Rights Holders



# Interconnection to the Desert Southwest – 1996

## Mead-Adelanto & Mead-Phoenix 500 kV lines \*

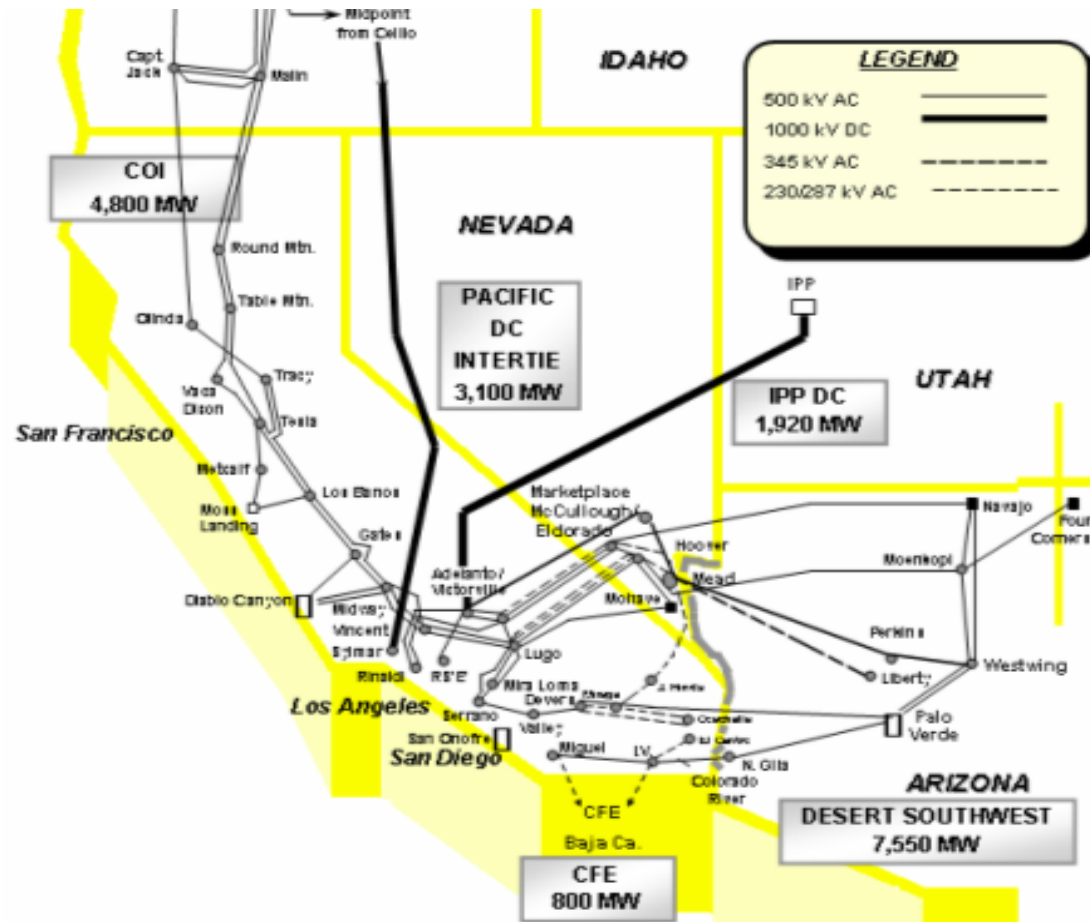
- SPPA
- Vernon
- Redding
- Santa Clara
- Modesto
- WAPA (Lower-Colorado)



\* Initial Line Owners and Rights Holders

# California's Current Transmission Interconnections

	MW
COI	4,800
Pacific DC	3,100
IPP DC	1,920
CFE	800
Desert SW	7,550



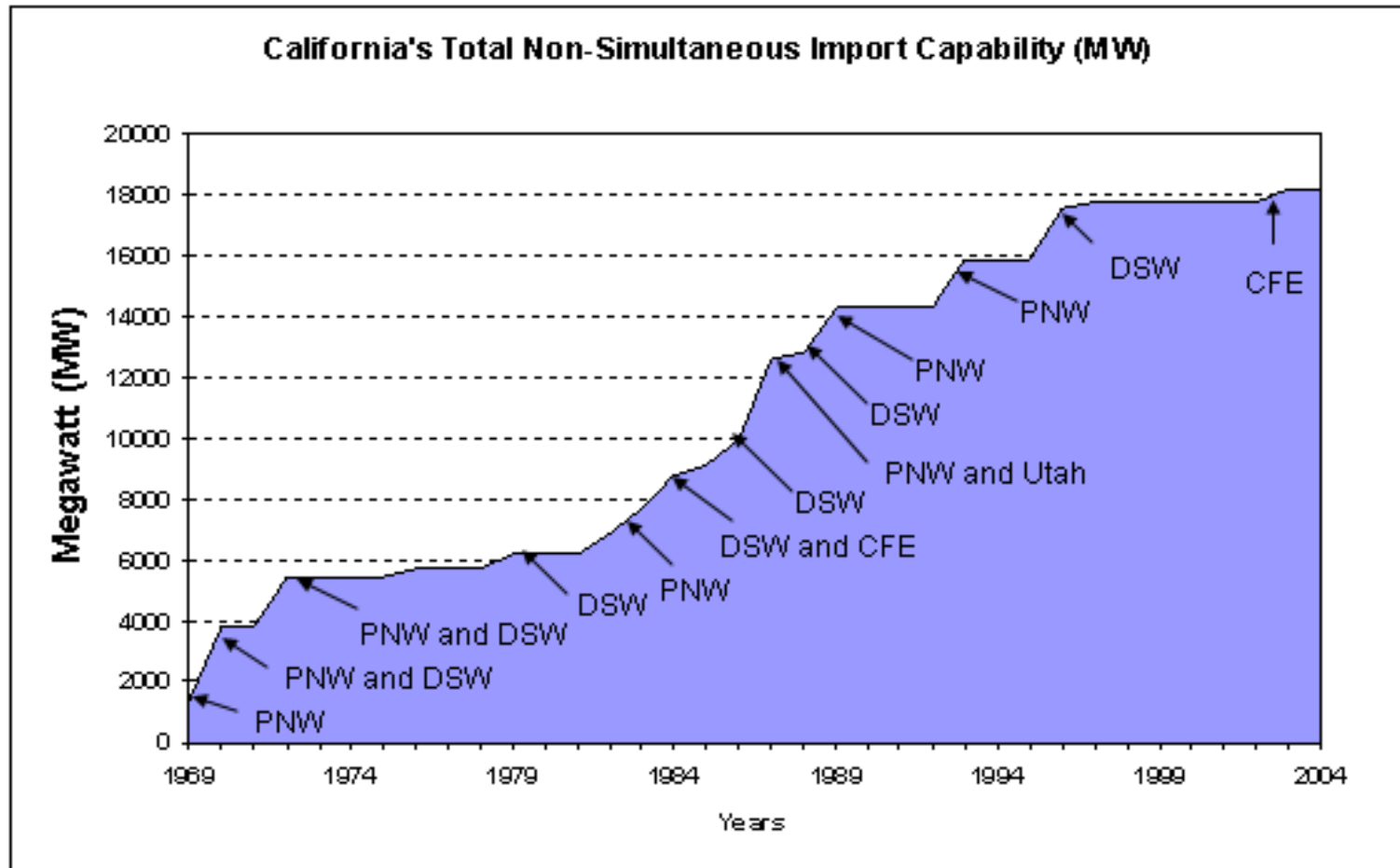
# California's Transmission is Well Integrated With the WECC to Maximize Value

California's interconnections were developed to obtain strategic benefits:

- Reliability
- Load diversity
- Fuel diversity
- Access to power plants
- Firm purchases
- Economy energy and surplus hydro purchases
- Power exchanges
- Reserve sharing



# California's Non-Simultaneous Import Capability



# *Benefits and Value of Transmission Interconnections*

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- Reliability – Reduction in In-State Reserve Margins
- Access to Regional Markets and Resource Diversity
- Environmental Benefits and Trade-offs
- Benefits During Abnormal System Conditions and Insurance Against Contingencies
- Secondary Benefits from Extra High Voltage Infrastructure

# *Reliability - Reduction in In-state Reserve Margins*

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Present value savings of \$750 Million to \$1.3 Billion

- Over the last 25 years, California resource planners have come to rely on 2,500 MW of economy imports made possible by the transmission grid. This has, effectively, lowered in-state capacity reserve margins by 3-5 percent.
- Transmission interconnections between regions with seasonal load diversity provide an opportunity to reduce planning reserve margins.
- Lower reserve margins results in more efficient utilization of existing generating resources region wide.

# *Access to Regional Markets and Resource Diversity*

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Natural gas has been California's marginal fuel source for electric production since the early 1980s. Transmission access to diverse markets within the Western Interconnection has provided substantial value in enabling California to improve its fuel diversity, minimize power production costs, and reduce emissions.

- In the mid-80s, as a result of the California's significant EHV infrastructure, resulted in the formation of the Western System Power Pool (WSPP). The WSPP provided an umbrella agreement that allowed participants to enter into a wide variety of energy, capacity, and transmission transactions.
- The PNW, dominated by renewable hydro resources with historically lower marginal costs.
- The DSW, dominated by coal with historically lower marginal costs.
- In 1998 and 1999, California imported approximately 48,000 GWh or 18% of its total energy requirement.
- Regional access to non-gas resource provides price stability to an otherwise volatile natural gas market.

# *Environmental Benefits and Trade-offs*

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In the 1980s and 1990s both the PNW and California received significant environmental benefits associated with “environmental energy exchanges.”

- The California benefits - reduced NOx pollution from gas-fired plants.
- The environmental benefit for the PNW was in the ability to maintain a constant flow on the many rivers, with no increased hydro spill, during the critical fish flush and fish migration periods.
- Imports from the DSW have also reduced California NOx pollution from gas-fired power plants, especially in non-attainment areas (e.g. SCAQMD).
- Reliance on out of state generation has led to export of environmental impacts.
- Generation has come from a variety of remote sources including, nuclear, coal, and now, increasingly, gas.

# *Benefits During Abnormal System Conditions and Insurance Against Contingencies*

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- During the oil embargo, California was able to save over \$100 million per month in differential fuel costs
- Imports provide an option to offset the loss of low cost base load generation
  - Mohave station shut down in 1985 for ~ four months due to reheat piping failure
  - Palo Verde Nuclear Plant outage in the mid '80's, ordered by the NRC due to steam generator issues
- Above average attractively priced imports from the PNW during wet periods resulted in substantial energy cost savings. For example, California saved over \$900 million in 1984 alone, which was more than the total investment in the Pacific Intertie.

# *California's Secondary Benefits from Extra High Voltage Infrastructure*

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A key benefit associated with the development of the PACI transmission system was that it allowed for other beneficial uses and projects.

- A parallel effort to the Pacific Intertie planning during the 1960s was the development of the California Power Pool (CPP). The agreement addressed the necessary planning and coordination required to enhance their reliability and economic operation.
- In the development of the California aqueduct system, the state utilized the Pacific Intertie to provide the transmission infrastructure to which the many generators and pumping facilities of the California aqueduct could interconnect.

# *Energy Import Savings Methodology*

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- Annual energy savings based on economy energy imports

$$\text{Savings} = [a(b - c)]$$

a = Energy imports by region (MWh)

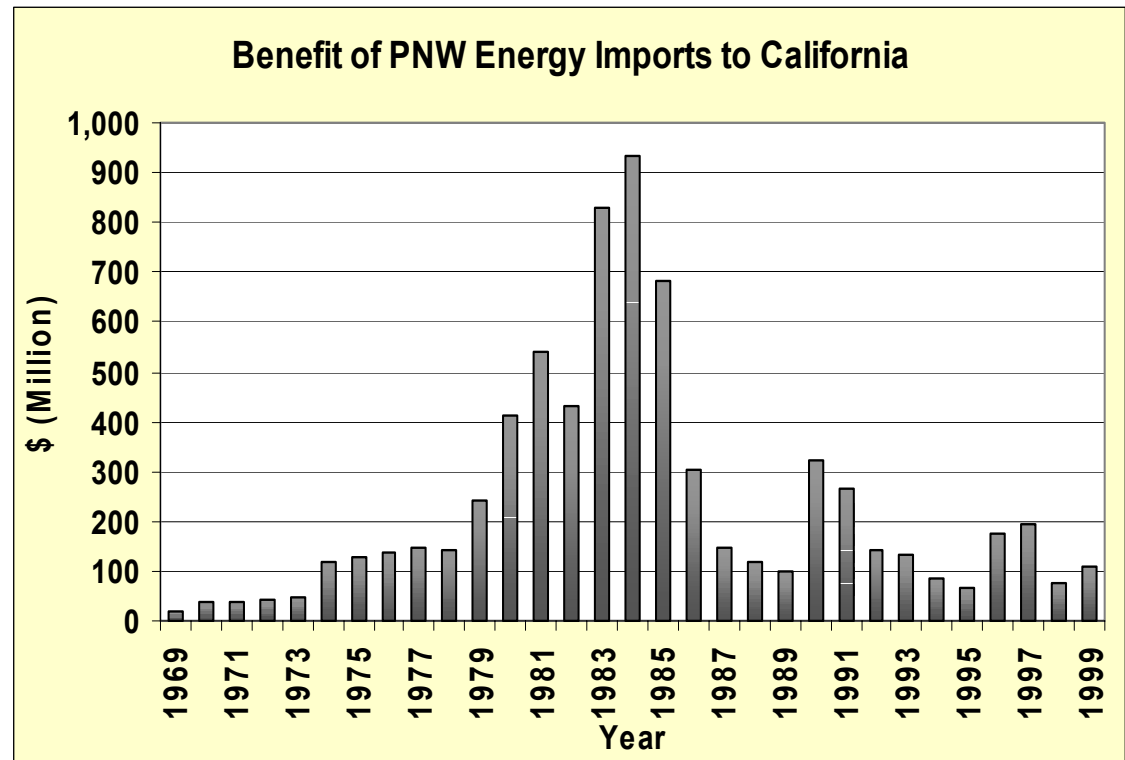
b = California's marginal cost of generation (\$/MWh)

c = Cost of economy energy imports by region (\$/MWh)

- CA marginal generation cost based on annual average fuel oil and natural gas prices multiplied by a 10,000 BTU heat rate
  - Fuel oil on the margin for the period 1969 through 1982
  - Natural gas on the margin for the period 1983 forward
  - Fuel prices as reported by EIA
- Excludes benefit from firm capacity and firm energy

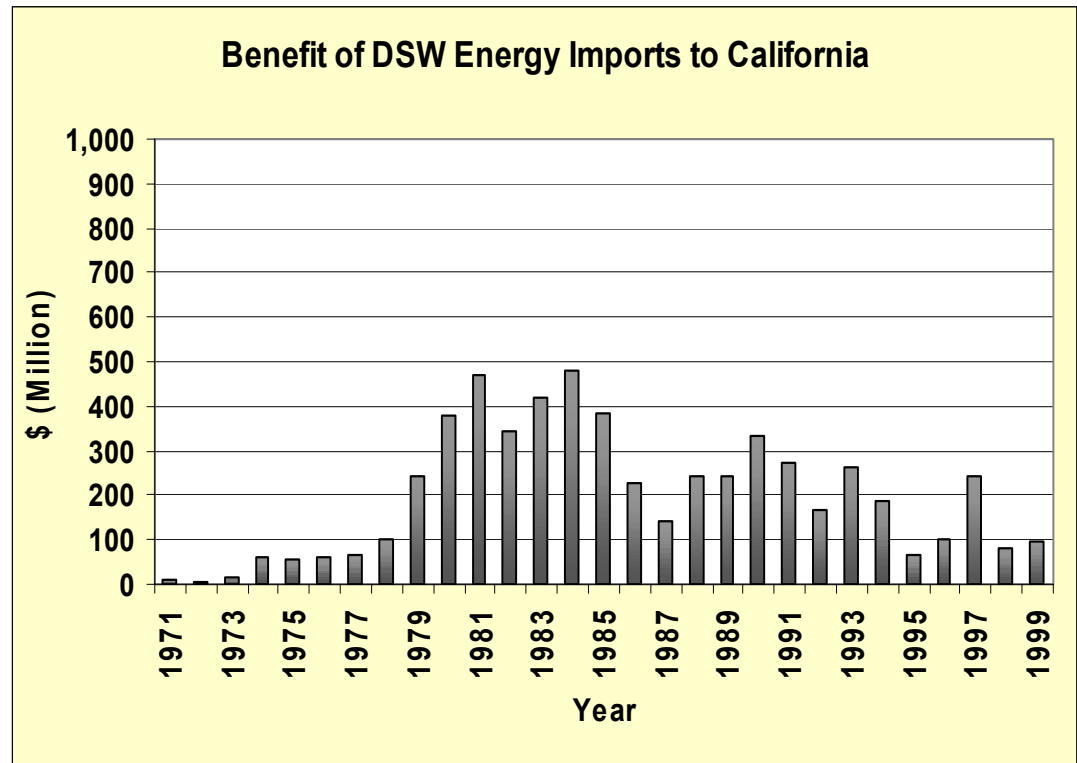
# *Historical Energy Import Savings - PNW*

- Cumulative savings since commercial operation of the EHV system to the PNW have been:
  - \$7.2 billion from the Pacific Northwest



# *Historical Energy Import Savings - DSW*

- Cumulative savings since commercial operation of the EHV system to the DSW have been:
  - \$5.7 billion from the Desert Southwest
- Utah Imports - IPP units output and imports up to line capability have provided significant additional fuel savings for the Southern California Municipalities



# ***Summary Of The Benefits From California's Transmission Investment***

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Since the late 1960s, the investments in interconnections have totaled approximately \$4.1 billion. These investments have produced substantial benefits as summarized below:

- Import capability of 18,170 MW. The equivalent amount of peaking capacity from power plants would require an investment of approximately \$10 billion.
- Access to hydro, coal, geothermal, wind, and nuclear power from outside of California.
- Import of California utility-owned or contracted generation totaling nearly 6,000 MW from the Desert Southwest (DSW) and Utah.
- Reduction in required planning reserves of 1,500 to 2,500 MW with an associated present value savings of \$750 million to \$1.3 billion
- Savings from energy imports totaling \$7.2 billion from the Pacific Northwest (PNW) and \$5.7 billion from the DSW

# *Status Of Current Transmission Needs And Future Strategic Interconnections*

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## Reliability and Market Operations

- Path 15 – In spite of the State's lack of action the project is going forward under the direction of Department of Energy/WAPA and an independent transmission company. Operating date January 2005.
- Path 26 –A 400 MW path rating increase was approved by the WECC in July of 2003, may eventually require a major reinforcement project.
- Rainbow-Valley Project – In June of 2003, the CPUC voted not to approve the project.

# *Status Of Current Transmission Needs And Future Strategic Interconnections (Cont.)*

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## **Access to Markets**

- Devers-Palo Verde No. 2 – In the recent CPUC long-term resource procurement proceedings, Southern California Edison (SCE) indicated its intention to build a second 500 kV line between the Devers Substation in the Palm Springs area and the Palo Verde Nuclear Plant, 50 miles west of Phoenix, Arizona. The expected operating date is 2008.

## **Access to Stranded Renewables**

- Tehachapi - To meet California's objective of encouraging the development of renewable resources, SCE has proposed a project that would expand its transmission system in the Tehachapi area, for wind generation developers.

## **Load Pockets**

- San Francisco – construct a new 230 kV line to support the peninsula load.
- San Diego pursuing alternatives to Rainbow-Valley project.
- Silicon Valley/San Jose – reinforce the 115 kV system in the southern portion of the area.

# *National Planning And Policy Issues*

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The following is a summary of the national planning, policy issues and challenges faced by ISOs in obtaining regulatory approval for transmission projects that offer economic and strategic benefits:

- Lack of the necessary market models to adequately forecast and “prove” project justification.
- Lack of established processes for reviewing and approving economic projects.
- Long and uncertain regulatory approval processes, especially for multi-state projects.
- Transmission Owners’ uncertainty about cost recovery and regulatory treatment.
- Disconnect between who pays for new transmission vs. who benefits.
- Lack of deliverability standard for connecting new generation.
- Shorter lead times required for generation solutions than those for transmission projects and can provide a quicker fix to many bottlenecks.
  - Recent generation project cancellations around the nation are creating challenges for the grid planners and eventually customers.
- Limited data available on planned new generation projects to support long term planning studies.

# *California's Future Transmission Grid – Policy Issues And Impediments*

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- Long Planning Horizon
  - A good target for California's future transmission grid would be to look ahead 25 to 30 years.
- Planning Methodologies for Evaluating Transmission Projects
  - Incorporating the strategic value of transmission for insurance against contingencies in project evaluations.
- Project Review Process and Cost Recovery
  - California needs clear, logical and orderly policies associated with transmission project review and approval processes.
- Asset Utilization During Market Dysfunction
  - There needs to be a strong regulatory, policy, and business framework in place to obtain the full benefit of transmission interconnections.

# *Strategic Issues For The Future Of California's Grid*

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- Interconnections for California's future grid need to take into account:
  - California's aging fleet of resources will result in plant retirements.
  - Qualifying Facilities (QFs) will come to the end of contract terms.
  - Economic recovery – returning load growth and the financial status of merchant suppliers — cancelled projects.
  - Lead times for transmission projects (8 to 10 years).
  - Economic justification for strategic transmission investments.
  - California's long-term plan must integrate with regional efforts and initiatives.
- Benefits of strategic transmission assets:
  - Reliability
  - Access to markets
  - Fuel diversity
  - Reduction of environmental impacts
  - Insurance against contingencies
  - Replacement of aging power plants

# *Recommendations*

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- Develop a long-term strategic vision and plan for California's Grid of the Future.
- Simplify regulatory review and approval process
  - Review all the involved processes associated with transmission projects and identify redundancies, gaps, and overlaps.
- Work with Western states to develop a coordinated approach to regional resource and transmission development.
- Formulate a policy on the appropriate level of investment for strategic transmission interconnections as insurance against contingencies and market disruptions.
- Review planning and project evaluation methodologies to incorporate strategic benefits of transmission in planning and regulatory approval process, including benefits of reliability, contingency insurance, efficient market operations, fuel diversity, and access to regional markets.
- Develop plans to achieve cost-effective fuel diversity.

# *Recommendations (Cont.)*

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- Develop plans to access new and developing markets in the Western Interconnection.
- Provide greater certainty to the issues associated with cost recovery and cost allocation.
- Promote greater operational and planning coordination of transmission assets between CAISO and municipalities, state and federal agencies.
- Identify actions that can be taken in the short term that will enhance and expedite California's long-term strategic development and expansion of the EHV system.
- Identify a desired level of import capability and maintain it through expansion projects. Current import capability is 35% of load demand level.
- Develop a technology plan to maximize existing transmission infrastructure utilization and ensure the future transmission grid.